121-001

Tuesday, September 11

1

$f'(x) = m_{TAN}$ = inst. rate of change

$f(2) = 3(2)^2 - 5(2) + 11$
$= 12 - 10 + 11 = 13$

point $(2, f(2))$
$= (2, 13)$

ex: $f(x) = 3x^2 - 5x + 11$

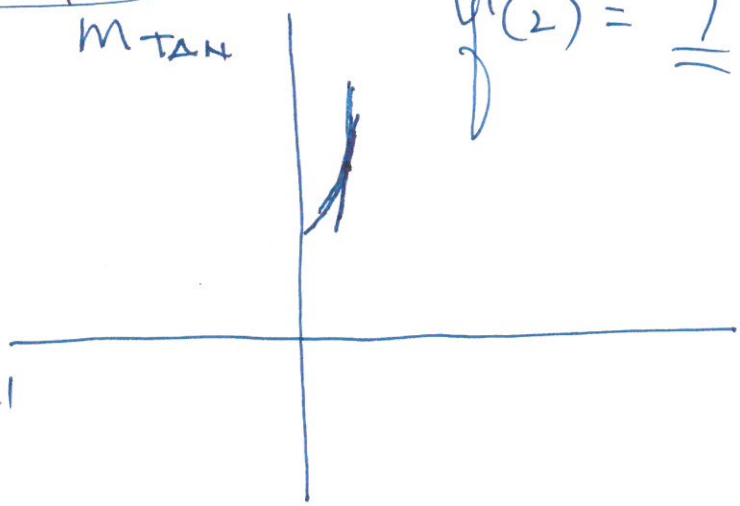
DEF. OF DERIV: $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

$f'(x) = 6x - 5$

m_{TAN}

$f'(2) = 6(2) - 5$

$f'(2) = 7$



$m_{TAN} = 0 \Rightarrow$ horizontal tangent line

power rule (exponent rule)

$$\begin{cases} f(x) = a \cdot x^n \\ f'(x) = a \cdot (n \cdot x^{n-1}) \end{cases}$$

polynomial (n = non-neg. int)

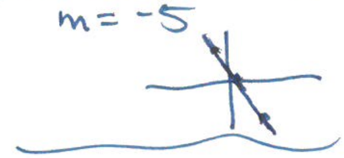
sum difference rule

$$\begin{cases} y = f(x) \pm g(x) \\ y' = f'(x) \pm g'(x) \end{cases}$$

③

$y = -5x$

$m = -5$



$y = 11$

$f(x) = 3x^2 - 5x^1 + 11x^0$

$f'(x) = 3\cdot[2\cdot x^{2-1}] - 5\cdot[1\cdot x^{1-1}] + 11\cdot[0\cdot x^{0-1}]$

$f'(x) = 6x - 5 + 0$

$f'(x) = 6x - 5$

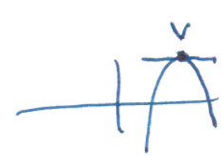
$f(x) = \frac{4}{2x+1} = 4(2x+1)^{-1}$ $\qquad f'(x) = \underline{\qquad}$

not power rule

$g(x) = a\cdot x^2 + b\cdot x^1 + C$ any parabola ($a \neq 0$)

$g'(x) = a\cdot(2x^1) + b(1\cdot x^0) + 0$

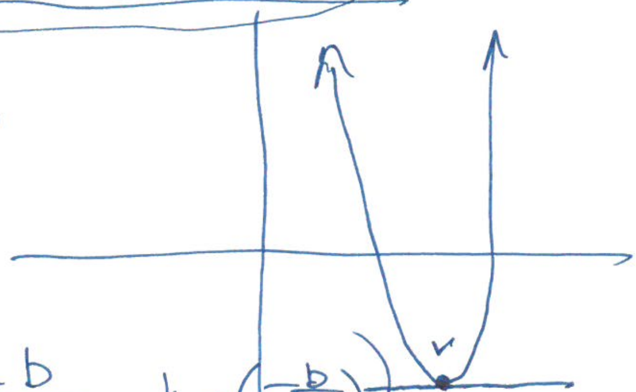
$g'(x) = 2ax + b = m_{TAN}$



$0 = 2ax + b$

$-b = 2ax$

$\frac{-b}{2a} = x$



vertex $\left(\frac{-b}{2a}, \cancel{f}\, g\left(\frac{-b}{2a}\right)\right)$

$m_{TAN} = 0 = g'(x)$

$$f(x) = a \cdot x^n$$

ex: $f(x) = \underline{7}\, x^{-3}$

$$f'(x) = 7 \cdot (-3 \cdot x^{-4}) = -21x^{-4}$$

or $= \boxed{\dfrac{-21}{x^4} = f'(x)}$

$f'(0)$ undef.

$f'(x) = \text{NEG}$

curve is DECR.

$$\boxed{f(x) = \frac{13}{7} \cdot x^{2/3}}$$

$$f'(x) = \frac{13}{7} \cdot \left[\frac{2}{3} \cdot x^{2/3 - 1}\right]$$

$$f'(x) = \frac{13}{7} \cdot \frac{2}{3} \cdot x^{-1/3} = \frac{26}{21} x^{-1/3}$$

$$f'(x) = \frac{26}{21 \cdot \sqrt[3]{x}} = \frac{26}{21 \cdot \sqrt[3]{x}} = f'(x)$$

$f'(0) = \text{D.N.E.}$

$g(x) = 12\sqrt{x}$

x	y
0	0
1	12
4	24

rewrite:

$g(x) = \underline{12} \cdot x^{1/2}$

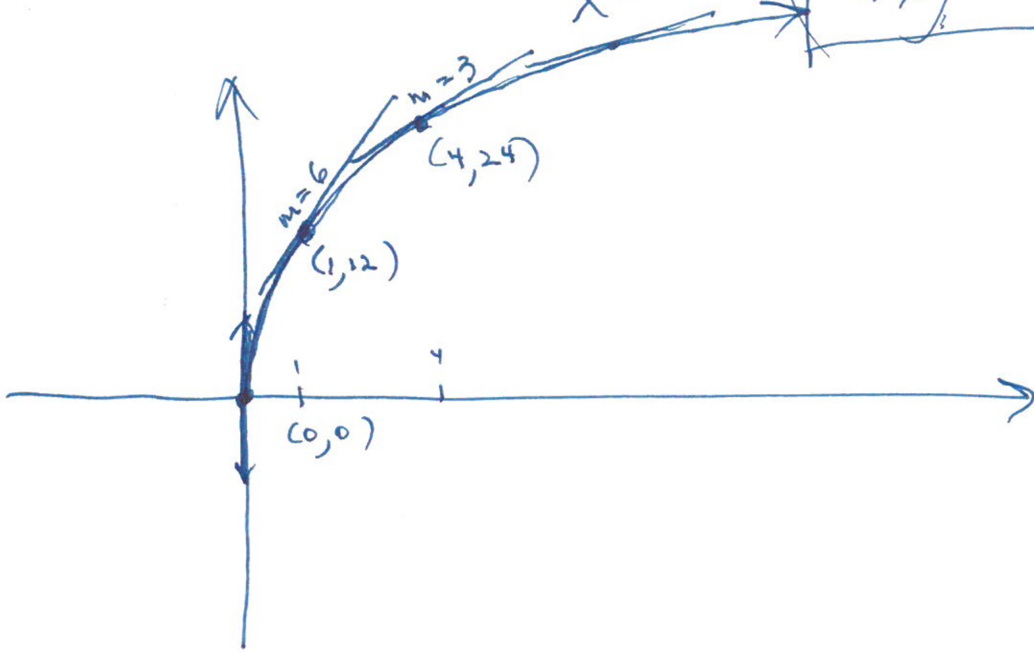
$\frac{1}{2} - 1$

$m_{TAN} = g'(x) = 12 \cdot \left(\frac{1}{2} \cdot x^{-1/2}\right)$

$g'(x) = \dfrac{6}{x^{1/2}} = \boxed{\dfrac{6}{\sqrt{x}}} = g'(x) = m_{TAN}$

x	y'
0	D.N.E.
1	6
4	3

VERT TANG. LINE



$y = x^2 - \sqrt{x}$

find the equation of the tangent line to this function at the point $(4, 14)$

$y - y_1 = m(x - x_1)$

$y - 14 = m(x - 4)$

slope of the tangent line $= m_{TAN} = y'$

$y = x^2 - x^{1/2}$

$m_{TAN} = y' = 2x - \frac{1}{2}x^{-1/2}$

$y' = 2x - \frac{1}{2 \cdot \sqrt{x}}$

$y' = ??$ when $x = 4$

$y' = 2(4) - \frac{1}{2 \cdot \sqrt{4}} = 8 - \frac{1}{4} = \frac{32}{4} - \frac{1}{4}$

$y' = \frac{31}{4} = m$

* $y - 14 = \frac{31}{4}(x - 4)$ ✓

W.A.: $y = \frac{31}{4}(x-4) + 14$

$y = \frac{31}{4}x - \frac{31}{4} \cdot 4 + 14$

1.6:

product & quotient rules:

deriv of product $\neq$ prod. of deriv.

$y = x^2$ | $y = x^2 = x \cdot x$

$y' = 2x$ $\longleftrightarrow$ $y' \neq 1 \cdot 1 = 1.$

---

prod. rule:

$y = f(x) \cdot g(x)$

$y' = f(x) \cdot g'(x) + g(x) \cdot f'(x)$

ex: $y = (3x+1)(5x-4)$

$y' = (3x+1) \cdot 5 + (5x-4)3$

$y' = 15x + 5 + 15x - 12 = 30x - 7$

check: $y = 15x^2 - 7x - 4$

$y' = 15(2x) - 7 - 0$

$y' = 30x - 7$

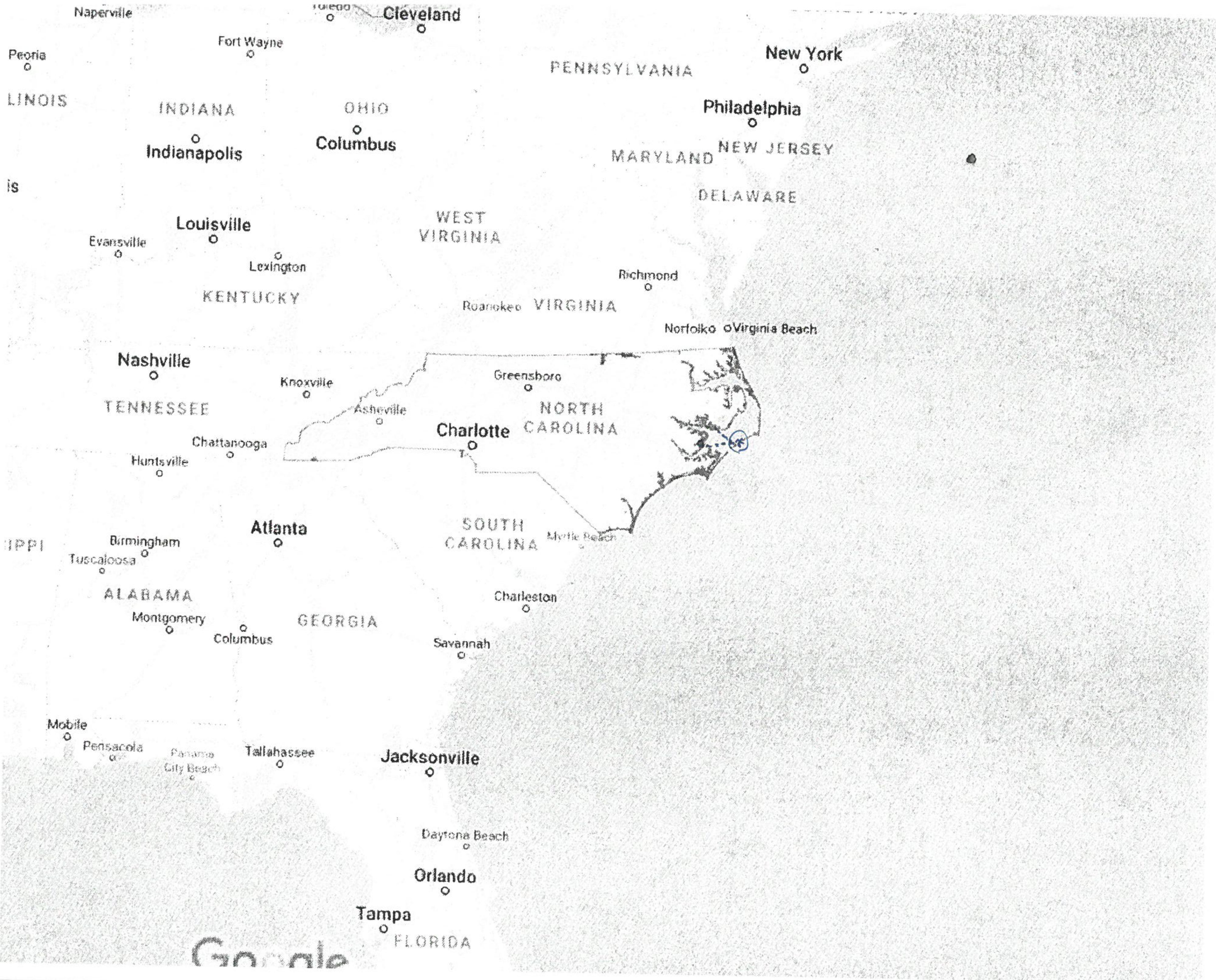
<u>quotient rule:</u>

$$y = \frac{f(x)}{g(x)} \qquad y' = \frac{g(x) \cdot f'(x) - f(x)\, g'(x)}{[g(x)]^2}$$

$$y = \frac{2x+1}{3x-4} \qquad y' = \frac{(3x-4)\cdot(2) - (2x+1)\cdot(3)}{(3x-4)^2}$$

$$y' = \frac{\cancel{6x} - 8 - \cancel{6x} - 3}{(3x-4)^2}$$

$$y' = \frac{-11}{(3x-4)^2}$$



Naperville
Cleveland
Fort Wayne
Peoria
New York
PENNSYLVANIA
Philadelphia
INDIANA
OHIO
Indianapolis
Columbus
MARYLAND
NEW JERSEY
DELAWARE
Louisville
WEST VIRGINIA
Evansville
Lexington
Richmond
KENTUCKY
Roanoke
VIRGINIA
Norfolk
Virginia Beach
Nashville
Knoxville
Greensboro
Asheville
NORTH CAROLINA
TENNESSEE
Charlotte
Chattanooga
Huntsville
Atlanta
SOUTH CAROLINA
Myrtle Beach
Birmingham
Tuscaloosa
ALABAMA
Charleston
Montgomery
Columbus
GEORGIA
Savannah
Mobile
Pensacola
Tallahassee
Jacksonville
Daytona Beach
Orlando
Tampa
FLORIDA